Remarks/Arguments

In response to the Office Action mailed September 12, 2006, Applicants respectfully request that the Examiner reconsider the rejections of the remaining claims.

Claims 1-27 are pending in the Application.

Claims 1-27 stand rejected.

Maintained double patenting rejections

I. DOUBLE PATENTING REJECTIONS OVER CO-PENDING APPLICATION NO. 10/764,092

The Examiner has maintained the provisional rejection of Claims 1-7 under the judicially-created doctrine of obviousness-type double patenting as being unpatentable over Claims 1-11 of co-pending Application No. 10/764,092 (the '092 Application). Office Action, at I. page 2. Additionally, the Examiner has provisionally rejected Claims 8-18 (added in the response filed February 16, 2006) over the same Claims in the '092 Application.

Applicant respectfully traverses these rejections. Applicant notes that, if the "provisional" double patenting rejection is the only rejection remaining in the Application, then the Examiner should withdraw the rejection and permit the Application to issue as a patent. M.P.E.P. §804.

II. DOUBLE PATENTING REJECTIONS OVER CO-PENDING APPLICATION NO. 10/738,168

The Examiner has maintained the provisional rejection of Claims 1-7 under the judicially-created doctrine of obviousness-type double patenting as being unpatentable over Claims 1-28 of co-pending Application No. 10/738,168 (the '168 Application). Office Action, at II. page 2-3. Additionally, the Examiner has provisionally rejected Claims 8-18 over the same Claims in the '168 Application.

Applicant respectfully traverses these rejections. Applicant notes that, if the "provisional" double patenting rejection is the only rejection remaining in the Application, then the Examiner should withdraw the rejection and permit the Application to issue as a patent. M.P.E.P. §804.

New Double Patenting Rejections

I. DOUBLE PATENTING REJECTIONS OVER CO-PENDING APPLICATION NO. 10/764,092

The Examiner has provisionally rejected Claims 19-27 under the judicially-created doctrine of obviousness-type double patenting as being unpatentable over Claims 1-11 of co-pending Application No. 10/738,168 (the '092 Application). Office Action, at I. page 5.

Applicant respectfully traverses these rejections. Applicant notes that, if the "provisional" double patenting rejection is the only rejection remaining in the Application, then the Examiner should withdraw the rejection and permit the Application to issue as a patent. M.P.E.P. §804.

II. DOUBLE PATENTING REJECTIONS OVER CO-PENDING APPLICATION NO. 10/738,168

The Examiner has provisionally rejected Claims 19-27 under the judicially-created doctrine of obviousness-type double patenting as being unpatentable over Claims 1-28 of co-pending Application No. 10/738,168 (the '168 Application). Office Action, at II. page 6.

Applicant respectfully traverses these rejections. Applicant notes that, if the "provisional" double patenting rejection is the only rejection remaining in the Application, then the Examiner should withdraw the rejection and permit the Application to issue as a patent. M.P.E.P. §804.

I. Rejections under 35 USC 102/103 Claims 1 and 3-7

Claims 1 and 3-7 stand rejected under 35 U.S.C. § 102(b) as being anticipated by or, in the alternative, under 35 U.S.C. § 103(a) *Hong et al.* ("Synthesis of Carbon Nanotubes by Microwave Heating," Proceedings of the Sixth Applied Diamond Conference/Second Frontier Carbon Technology Joint Conference (ADC/FCT 2001), July 1, 2001, pp. 805-809) in combination with DE 3,915,044 ('044). Office Action I. at pp. 7-10. Applicants respectfully traverse these rejections.

102(b)

Claim 1 recites a method for *crosslinking carbon nanotubes* comprising the steps of (1) providing carbon nanotubes and (2) *irradiating said nanotubes* with microwave radiation to crosslink the carbon nanotubes.

By contrast Hong et al. describes a method for the *synthesis of carbon nanotubes* on cobalt sulfide catalyst particles. The method comprises *locally* heating cobalt sulfide catalysts with microwaves in an acetylene atmosphere so as to grow [multi-wall] carbon nanotubes (CNTs) on a polymer substrate. *See Hong*, p. 806, *ll.* 6-12. Because such heating is localized *at the cobalt sulfide particles*, "[t]he substrate is not heated by the microwave [*sic*], so that it is possible to incorporate CNTs with organic polymers in various applications." *Id.* Thus, Hong discloses providing acetylene gas feedstock for carbon nanotube synthesis *not* providing carbon nanotubes. Furthermore, Hong does *not* disclose the step of irradiation of the carbon nanotubes. Rather, Hong relies on local heating of a catalyst for carbon nanotube synthesis.

An anticipation rejection of a claim under 35 U.S.C. §102(b) requires identity of invention; each and every feature of the claim must be identified by the Examiner, either explicitly or inherently, in a single prior art reference. Further, to establish inherency, extrinsic evidence must make clear that the missing descriptive matter is necessarily present in the device or system described in the reference, and that it would be so recognized by persons of ordinary skill in the art. *In re Robertson*, 169 F.3d 743, 49 USPQ2d 1949 (Fed. Cir. 1999). Inherency may not be established by probabilities or possibilities; the mere fact that a certain thing may result from a given set of circumstances is not sufficient to establish inherency. *Scaltech, Inc. v. Retech/ Tetra L.L.C.*, 156 F.3d 1193, 51 USPQ.2d 1055 (Fed. Cir. 1999). The Examiner has not

met this burden as to the claims of the present application. That is, the appearance of nanofibers, nanoparticles and amorphous carbon does not establish an inherent presence of crosslinked carbon nanotubes. Furthermore, the growth of CNTs is provided by the carbon feedstock acetylene, not by accretion of material from parent CNTs by microwave irradiation as implied by the Examiner. Hong discloses that the microwave irradiation is local to the metal sulfide catalyst. Applicants therefore respectfully request withdrawal of the rejection based on anticipation by Hong et al. Claims 3-7 depend from claim 1 and should patentable over Hong for at least the same reasons.

103(a)

In response to the Examiner's obviousness rejection of Claim 1, exactly how the method of *Hong* is to be modified is not clearly articulated by the Examiner. That is, there is no teaching, disclosure, or even a suggestion as to ***how*** one (of ordinary skill in the art) would alter the experimental procedure of *Hong* from using microwaves to locally heat the cobalt sulfide catalyst particles in an acetylene atmosphere (so as to grow CNTs) to selectively microwaving the CNTs (so as to crosslink them). It is not even evident that such modification could be done in the "flowing reactant gases" in which the microwave irradiating was carried out. *See Hong*, p. 806, *ll.* 39-40. At the very least, *Hong* fails to teach, disclose, or suggest all of the limitations of Claims 1.

Furthermore, Hong's teachings are directed to the *synthesis* of carbon nanotubes. Modification of the Hong procedure to *crosslink* carbon nanotubes would teach away from this very purpose. The Examiner is reminded that a proposed modification cannot change the principle of operation of the prior art being modified, nor can the proposed modification render the prior art unsatisfactory for its intended purpose. *See* M.P.E.P. 2143.01, *see also In re Ratti*, 270 F.2d 810, 123 U.S.P.Q. 349 (CCPA 1959) and *In re Gordon*, 733 F.2d 900, 221 U.S.P.Q. 1125 (Fed. Cir. 1984), respectively.

Examiner appears to argue that the method of *Hong* ***inherently*** microwaves the CNTs (while they are being grown) to yield a plurality of crosslinked CNTs. Applicants traverse such a position. Because *Hong* is silent about the supposed "inherent" characteristic suggested by

Examiner, the Examiner must fill this gap by recourse to extrinsic evidence. *Continental Can Co. v. Monsanto Co.*, 948 F.2d 1264, 1269, 20 U.S.P.Q.2d 1746, 1749 (Fed. Cir. 1991). "Such evidence must make clear that the missing descriptive matter is ***necessarily*** present in the thing described in the reference, and that it would be so recognized by persons of ordinary skill." *Id.* (emphasis added). Moreover, inherency, may not be established by probabilities or possibilities; the mere fact that a certain thing ***may*** result from a given set of circumstances is not sufficient to show this feature is present. *Id.* In the present circumstance, the supposed "inherent" characteristic is not supported by any evidence. Applicant points out that there is no evidence that the CNTs of *Hong* were heated by the microwave radiation. Furthermore, there is no evidence that the CNTs of *Hong* were crosslinked. Their transmission electron microscopy analysis (*see Hong*, Fig. 3b) clearly evidences that they had the capability of observing whether such crosslinking had occurred, yet none was reported. Given that this would have been a significant finding, it is implausible that such crosslinking would have been observed but not reported by *Hong*. Thus, the only reasonable conclusion is that no such crosslinking occurred in *Hong*.

As a separate basis of non-obviousness, and in addition to the above arguments, there is also no motivation for modifying the method of *Hong* to irradiate the CNTs with microwaves to yield a plurality of crosslinked nanotubes—as required by Claim 1, and all of the Claims depending there from. *Hong* states that "microwave induced reaction [*sic*] made it possible to incorporate CNTs with low melting point materials such as organic polymers," and that "[i]t may become an important advancement to the fabrication of flexible field emission display [*sic*]." *Hong*, p. 809, *ll.* 10-12. Use of CNTs as field emitters in such displays is well established, but crosslinking of the CNTs would introduce defects in the CNTs along their length, intuitively hindering their suitability to function in such a manner. Again, *Hong* <u>*teaches away*</u> from irradiating the CNTs to yield a plurality of crosslinked CNTs, and any modification of *Hong* that leads to crosslinking would render *Hong* unsatisfactory for its intended purpose.

The examiner states that *Hong* teaches a similar process as presently claimed and would therefore be expected to yield the products that have inherently the same properties. Applicant respectfully traverses this interpretation of the process presented in claim 1. The process of

claim 1 specifically involves subjecting *carbon nanotubes to microwave irradiation* to effect crosslinking. *Hong* subjects *a metal sulfide catalyst to local microwave irradiation* in the presence of acetylene feedstock to synthesize carbon nanotubes. These are *not* similar processes *and* they yield different products. Again, there is no evidence that the CNTs of *Hong* were crosslinked. Their transmission electron microscopy analysis (*see Hong*, Fig. 3b) clearly evidences that they had the capability of observing whether such crosslinking had occurred, yet none was reported. Thus, there is no unappreciated property of the *Hong* composition concerning the presence of crosslinked carbon nanotubes as suggested by the Examiner. Nor is there some unrecognized motivation or advantage in the *Hong* process which renders the present claim obvious as suggested by the Examiner.

Finally, the Examiner points out that the microwave radiation is generated by a magnetron, as recited in claim 5 and that this is taught by DE '044. However, Claim 5 depends from Claim 1 and thus incorporates all Claim 1 limitations. DE '044 adds nothing of substance relevant to claim 1 and is also non-analogous art. Thus, Claim 1 is patentable over the combination. Claim 5 is patentable over the combination of Hong and DE '044 for at least the same reasons.

Accordingly, Claim 1 is not obvious in view of *Hong* alone or in combination with DE '044. Additionally, all Claims depending there from (all remaining Claims so rejected, *i.e.*, Claims 3-7), are not obvious in view of *Hong* by virtue of their dependence, either directly or indirectly, on Claim 1. *See In re Fine*, 837 F.2d 1071, 5 U.S.P.Q.2d 1596 (Fed. Cir. 1988).

II. Rejections under 35 USC 102/103 Claims 8, 11-12, and 14-18

Claims 8, 11-12 and 14-18 stand rejected under 35 U.S.C. § 102(b) as being anticipated by or, in the alternative, under 35 U.S.C. § 103(a) *Hong et al.* ("Synthesis of Carbon Nanotubes by Microwave Heating," Proceedings of the Sixth Applied Diamond Conference/Second Frontier Carbon Technology Joint Conference (ADC/FCT 2001), July 1, 2001, pp. 805-809) in combination with DE 3,915,044 ('044). Office Action II. at pp. 10-12. Applicants respectfully traverse these rejections.

Claim 8 is patentable for the same reasons stated above for Claim 1. Thus, Claim 8 is patentable over *Hong* either alone or in combination with DE '044. Claims 11-12 and 14-18 depend from Claim 8 and are therefore patentable for at least the same reasons.

Claims 1, 8 and 19 are amended herein. No new matter has been added by these amendments. Applicants respectfully submit that the Claims as they now stand are patentably distinct over the art cited during the prosecution thereof.

With the addition of no new claims, no additional filing fees are due. However, Applicants respectfully request a one month extension of time to file this response. Enclosed with this report is Form PTO/SB/22 with extension fees in the amount of $60.00. The Director is hereby authorized to charge any fees or credit any overpayment to Deposit Account Number of WINSTEAD SECHREST & MINICK P.C. (referencing matter 11321-P060US).

If the Examiner has any questions or comments concerning this paper or the present application in general, the Examiner is invited to call the undersigned at (713) 650-2764.

Dated:

1/8/07

Respectfully submitted,

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CERTIFICATE OF MAILING UNDER 37 C. F. R. § 1.10

I hereby certify that the attached *Petition for Extension of Time* and *Amendment and Response to Office Action* are being deposited with the USPS, as "Express Mail – Post Office to Addressee", mailing label number EL812635325US, addressed to Mail Stop Amendment, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on the date below.

1/8/07
Date

Signature

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